Humpback Chub Genetics Management Plan

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Outline

✓ History of GMP

✓ Overview of Policy Regarding Controlled Propagation of Species Listed Under the Endangered Species Act
  ✓ Genetic Risks
  ✓ HBC GMP recommendations to avoid these risks
History of Genetics Management Plan

✓ Originated as part of HBC Comprehensive Management Plan

✓ AMWG passed revised motion in 2006 to fund: “To use $50,000 in funds reprogrammed from CPI to support a HBC Genetics Plan, including a refugia plan and additional sampling”

✓ Draft reviewed by HBC Comprehensive Management Plan ADHOC in 2008, comments incorporated: “Recommendation to have externally reviewed”
History of Genetics Management Plan

- GCMRC facilitated external review in 2009, draft reviewed by 2 genetic experts and 1 hatchery expert and comments were incorporated
- USFWS Region II Regional Office review in 2010, cleared for external release
- Final provided to BOR in November 2010
Policy

✓ Policy Regarding Controlled Propagation of Species Listed Under the Endangered Species Act (CPP)
  ✓ Fish and Wildlife Service
  ✓ National Marine Fisheries Service

✓ Federal Register
  ✓ Vol. 65 No. 183, September 20, 2000

✓ Pacific salmon are exempted from this policy
Risks That Must Evaluated:

✓ Broodstock Mining
✓ Inbreeding
✓ Introgression
✓ Loss of Population Structure
✓ Domestication Selection
Risk: Broodstock Mining

✓ Removal of natural parental (adults) stock that may result in an increased risk of:
  ✓ extinction by reducing the abundance of wild individuals
  ✓ reducing genetic variability within naturally occurring populations
HBC - Recommendations

✓ Collect young-of-year
  ✓ two assurance populations -
    ✓ 200 YOY/alternate years for 5 years = 1,000 total per assurance population
  ✓ translocations
    ✓ 200 YOY per event

✓ Probability of their survival would have been low

✓ Does not recommend moving adults
Risk: Inbreeding

✓ The potential for an increased level of inbreeding or other adverse genetic effects within populations that may result in the enhancement of only a portion of the gene pool.
HBC - Recommendations

- Maintain pedigree record information
  - studbook keeper - designate preferred spawning pairs
Risk: Hybridization/Outbreeding

✓ Genetic introgression, which may diminish local adaptation of the naturally occurring population.
HBC - Recommendations

- Lower basin - lacks populations subdivision
  - can move around without harm
- Lower basin different from Upper basin
  - do not mix the two
- Move YOY
Risk: Domestication Selection

✓ Exposure to novel selection regimes in controlled environments that may diminish a listed species’ natural capacity to survive and reproduce in the wild.
HBC - Recommendations

✓ Maintain captive stock in outdoor ponds not in raceway culture
✓ NATURES rearing
Risk: Loss of Population Structure

 ✓ Potential erosion of genetic differences between populations as a result of mixed stock transfers or supplementation.
HBC - Recommendations

- Lower basin - lacks populations sub-division
  - can move around
- Lower basin different from Upper basin
  - do not mix the two
Other Risks (not in policy)

☑ Founder Effect
☑ Genetic Drift
☑ Augmentation/Ryman-Laikre Effect
Risk: Founder Effect

✓ Occurs when new population is started with few individuals
  ✓ lower genetic diversity than source population
HBC - Recommendations

- 200 YOY per event
  - translocation
  - collection for assurance populations
- PIT tagged and genotype all individuals
  - compare diversity to source population
Risk: Genetic Drift

✓ Genetic changes in a population associated with chance events
  ✓ few individuals contribute genes to next generation by chance
  ✓ loss of population diversity due to drift typically associated with small population size
Allele frequencies in gamete pool are exactly the same as the gamete-producing adults.

Random sample of 10 gametes drawn from the gamete pool:

<table>
<thead>
<tr>
<th>Generation</th>
<th>Frequency (white)</th>
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<tbody>
<tr>
<td>0</td>
<td>0.5</td>
</tr>
<tr>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td>3</td>
<td>0.4</td>
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</table>
Genetic Drift - Potential Risks

✓ Loss of alleles or reduction in genetic diversity
✓ Increase in genetic distance from source population/stock
✓ Fixation of deleterious mutations
HBC - Recommendations

- Monitor genetic variability
  - captive stock
  - wild populations
    - ongoing population monitoring - 30 individuals per year for duration of the management activity
      - especially translocation localities

- Spawn greater than 10 pairs
  - not in plan but general rule (Echelle, T. 1988)
    - minimum 25 pair
    - 50 - 100 pair for recovery
    - 100 pair for new broodstock
HBC - Recommendations

✓ Maintain large population sizes
  ✓ greater than 500

✓ Effective Population Size - not all individuals (census size) breed each year
  ✓ fraction that do = effective population size and on average is 14%
HBC - Recommendations

✓ Recover plan (2,100 individuals)
  ✓ Ne = 294

✓ Assurance Population A (1,000 indiv.)
  ✓ Ne = 140

✓ Assurance Population B (1,000 indiv)
  ✓ Ne = 140
HBC - Recommendations

✓ Total (captive and assurance)
  ✓ 4,100 individuals
  ✓ Ne = 574

✓ Close to theoretical 5,000 individuals needed to maintain genetic diversity over 100 year period

✓ Minimum theoretical number is 500, but plan calls for 2,100
Risk: Augmentation/Ryman-Laikre Effect

✓ Impact of the genetics of a wild population as a result of augmentation
  ✓ swamping of wild genetic diversity
    ✓ low genetic diversity but large numbers of propagated individuals
HBC - Recommendations

✓ Equalize family sizes
  ✓ no more than 5,000 from any one pair should be stocked
Thank You

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